

1 CLAIMS

2 What is claimed is:

3 1. An image processing method comprising the steps of:  
4 dividing an inputted image into pixel groups, each of  
5 which has a specified size;  
6 calculating a pixel group density for each of the  
7 divided pixel groups; and  
8 calculating an output value of a certain watched pixel  
9 based on an absolute density of the watched pixel and a  
10 relative density for the watched pixel, the relative density  
11 being calculated based on the pixel group density of the  
12 pixel group, to which the watched pixel belongs, and the  
13 pixel group density of the pixel group adjacent to the pixel  
14 group, to which the watched pixel belongs, among the pixel  
15 groups in the image.

16 2. The image processing method according to claim 1,  
17 wherein the step of dividing an inputted image into the  
18 pixel groups is meshing the image into sub images, each of  
19 which has a rectangular area.

20 3. The image processing method according to claim 1,  
21 wherein the relative density is calculated by use of an  
22 influence degree calculated based on a distance from the  
23 watched pixel and the pixel group, to which the watched  
24 pixel belongs, to the pixel group adjacent to the pixel  
25 group, each of the adjacent pixel group being located on and  
26 under and at the right and left of the pixel group.

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1 4. The image processing method according to claim 3,  
2 wherein in the step of calculating the pixel group den-  
3 sities, an average density of the divided pixel group is  
4 calculated, and

5 the relative density is obtained by multiplying the  
6 respective average densities of the pixel group, to which  
7 the watched pixel belongs, and of the pixel group adjacent  
8 to the pixel group, to which the watched pixel belongs, by  
9 the respective influence degrees.

10 5. The image processing method according to claim 1,  
11 wherein the relative density is calculated based on an  
12 influence degree obtained by a trapezoidal function repre-  
13 senting a positional relation between a coordinate position  
14 of the watched pixel and the pixel group adjacent to the  
15 pixel group, to which the watched pixel belongs.

16 6. The image processing method according to claim 1,  
17 wherein in the step of calculating an output value, the  
18 relative and absolute densities are weighted to calculate  
19 the output value.

20 7. A relative density detecting method for detecting a rela-  
21 tive density of a watched pixel constituting an inputted  
22 image, comprising the steps of:

23 dividing the image into pixel groups, each of which has  
24 a specified size;

25 detecting a pixel group density for each of the divided  
26 pixel groups;

27 extracting positional information for the watched pixel  
28 in a pixel group including the watched pixel; and

1           detecting a relative density of the watched pixel based  
2    on the pixel group density and the positional information.

3    8. An image processing apparatus comprising:  
4        pixel group dividing means for dividing an inputted  
5        image into pixel groups, each of which has a specified size;  
6        pixel group density detecting means for detecting a  
7        pixel group density for each of the pixel groups divided by  
8        the pixel group dividing means;  
9        weight deciding means for deciding each weight of the  
10      pixel groups adjacent to the pixel, to which a watched pixel  
11      belongs, based on a position of the watched pixel to be  
12      outputted;  
13        watched pixel density detecting means for detecting a  
14        density of the watched pixel; and  
15        relative density calculating means for calculating a  
16        relative density of the watched pixel based on a detected  
17        density of the watched pixel, a pixel group density of the  
18        detected pixel group and a decided weight of the pixel  
19        group.

20    9. The image processing apparatus according to claim 8, fur-  
21    ther comprising:

22        output density calculation means for calculating an  
23        output density by weighting the density of the watched pixel  
24        detected by the watched pixel density detecting means and  
25        the relative density calculated by the relative density cal-  
26        culating means.

27    10. The image processing apparatus according to claim 8,

1       wherein the pixel group dividing means roundly divides  
2    an inputted image into meshes, each of which has I pixels×J  
3    pixels (I, J: integers).

4       11. The image processing apparatus according to claim 8,  
5        wherein the weight deciding means comprises a table  
6        look-up for deciding weights of pixel groups adjacent to a  
7        pixel group, to which the watched pixel belongs, based on a  
8        coordinate position of the watched pixel, the pixel groups  
9        being located at the right and left of the pixel group, to  
10      which the watched pixel belongs, and/or on and under the  
11      pixel group, to which the watched pixel belongs.

12      12. The image processing apparatus according to claim 8,  
13        wherein the weight deciding means adds weights of pixel  
14        groups adjacent to a pixel group, to which the watched pixel  
15        belongs, to obtain a sum of 1, the pixel groups being  
16        located at the right and left of the pixel group, to which  
17        the watched pixel belongs, and/or adds weights of pixel  
18        groups adjacent to a pixel group, to which the watched pixel  
19        belongs, to obtain a sum of 1, the pixel groups being  
20        located on and under the pixel group, to which the watched  
21        pixel belongs.

22      13. An image processing apparatus for converting image data,  
23        which includes a specified object photographed by a digital  
24        camera, into a binarized image, comprising:  
25            a meshing unit for meshing the entire image data into  
26            sub images;

1       an average density detection unit for detecting an  
2       average density of each of the sub images meshed by the  
3       meshing unit; and

4       a density detection unit for detecting a density of a  
5       pixel constituting the object,

6       wherein a binarized image, in which an outline of the  
7       object is emphasized, is generated based on a detected den-  
8       sity of the pixel, an average density of the sub image, to  
9       which the pixel belongs, and an average density of the sub  
10      image adjacent to the certain sub image.

11      14. An article of manufacture comprising a computer usable  
12      medium having computer readable program code means embodied  
13      therein for causing image processing, the computer readable  
14      program code means in said article of manufacture comprising  
15      computer readable program code means for causing a computer  
16      to effect the steps of claim 1.

17      15. An article of manufacture comprising a computer usable  
18      medium having computer readable program code means embodied  
19      therein for causing relative density detection, the computer  
20      readable program code means in said article of manufacture  
21      comprising computer readable program code means for causing a  
22      computer to effect the steps of claim 7.

23      16. A program storage device readable by machine, tangibly  
24      embodying a program of instructions executable by the machine  
25      to perform method steps for causing image processing, said  
26      method steps comprising the steps of claim 1.

1       17. A program storage device readable by machine, tangibly  
2       embodying a program of instructions executable by the machine  
3       to perform method steps for causing relative density detec-  
4       tion, said method steps comprising the steps of claim 7.

5       18. A computer program product comprising a computer usable  
6       medium having computer readable program code means embodied  
7       therein for causing image processing, the computer readable  
8       program code means in said computer program product compris-  
9       ing computer readable program code means for causing a  
10      computer to effect the apparatus of claim 8.

DOCKET: 2007-00000